PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : F01B 3/00 — A1

(11) International Publication Number: WO 97/10415

(43) International Publication Date: 20 March 1997 (20.03.97)

(21) International Application Number: PCT/AL96/00001

(22) International Filing Date: 6 September 1996 (06.09.96)

(30) Priority Data:
PCT/EP95/03551 11 September 1995 (11.09.95) WO
(34) Countries for which the regional or international application was filed: NL et al.
AL/P95/00041 11 October 1995 (11.10.95) AL

(71)(72) Applicant and Inventor: TASI, Ylli [AL/AL]; Rruga e Kavajes Pallatet Cafod, Pall.A, Shk.2, Ap.10, Tirana (AL).

(74) Agent: TASI, Leke; Rruga e Kavajes Pallatet Cafod, Pall.A, Shk.2, Ap.10, Tirana (AL).

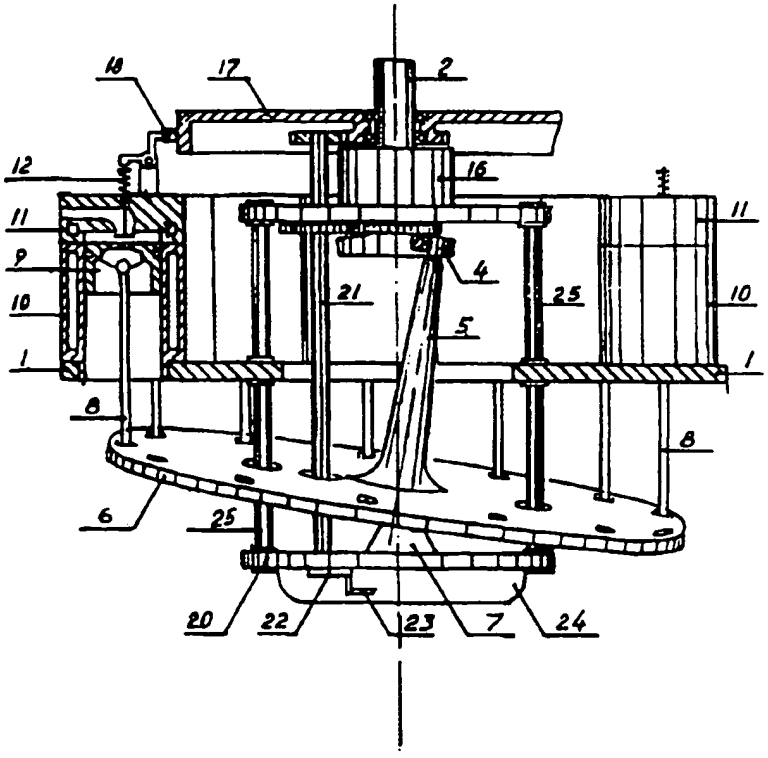
(81) Designated States: AL, AU, BG, BR, BY, CA, CN, CZ, GE, HU, IS, JP, KR, MW, MX, NO, NZ, PL, RO, RU, SG, SI, SK, TR, UA, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

(54) Title: PISTON DRIVEN AXIAL CYLINDER ENGINE

(57) Abstract

Piston driven axial cylinder engine is composed of the flange (1) with the cylinders (10) in a circular disposition, the support (16) of the motor main-shaft (2), and the carter (20) supporting the central pivot (7). Around this central pivot (7) the disc (6) has a mutating motion. The extremity (4) of the shaft describing a circle drives the shaft (2) in rotation. The disc (6) receives the extremity of the connecting rods (8). The distribution disc (17) with the cams (18), placed coaxially the motor main-shaft (2) whence it takes its rotations, commands the valves (12) and (13) placed in the cylinder heads (11). The shaft (21), which too takes its rotations from the motor main-shaft (2), serves to set in motion the auxiliary equipments. The pistons are set in motion, as in the case of internal combustion motors, their alternative straight-line motion being transformed in rotative motion of the motor main-shaft (2); and vice-versa.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AM	Armenia	GB	United Kingdom	MW	Malawi
AT	Austria	GE	Georgia	MX	Mexico
AU	Australia	GN	Guinea	NE	Niger
BB	Barbados	GR	Greece	NL	Netherlands
BE	Belgium	HU	Hungary	NO	Norway
BF	Burkina Faso	IE	Ireland	NZ	New Zealand
BG	Bulgaria	IT	Italy	PL	Poland
BJ	Benin	JP	Japan	PT	Portugal
BR	Brazil	KE	Kenya	RO	Romania
BY	Belarus	KG	Kyrgyzstan	RU	Russian Federation
CA	Canada	KP	Democratic People's Republic of Korea	SD	Sudan
CF	Central African Republic	KR	Republic of Korea	SE	Sweden
CG	Congo	KZ	Kazakhstan	SG	Singapore
CH	Switzerland	LI	Liechtenstein	SI	Slovenia
CI	Côte d'Ivoire	LK	Sri Lanka	SK	Slovakia
CM	Cameroon	LR	Liberia	SN	Senegal
CN	China	LT	Lithuania	SZ	Swaziland
CS	Czechoslovakia	LU	Luxembourg	TD	Chad
CZ	Czech Republic	LV	Latvia	TG	Togo
DE	Germany	MC	Monaco	TJ	Tajikistan
DK	Denmark	MD	Republic of Moldova	TT	Trinidad and Tobago
EE	Estonia	MG	Madagascar	UA	Ukraine
ES	Spain	ML	Mali	UG	Uganda
FI	Finland	MN	Mongolia	US	United States of America
FR	France	MR	Mauritania	UZ	Uzbekistan
GA	Gabon			VN	Viet Nam

PISTON DRIVEN AXIAL CYLINDER ENGINE

This invention aims at the construction of piston aggregates in general. such as internal combustion motors. compressors and hydraulic pumps. where the classic mechanism to transform motion-piston connecting-rod crank-shaft. is substituted by a new "Mechanism to transform alternative straight line motion into a rotary one and vice versa" presented in the International Application N PCT/EP 95/03551 Date 11. 09. 1996 and in the National Application in Albania N 1026 Date 11. 10. 1996

The internal combustion aggregates motors constructed according to this invention can be of two as well as of four stroke cycle aggregate motors. using naphtha (diesel) or benzine (gas). of small. medium. large or even very great power. and of an unlimited number of cylinders. They are described here below:

In cylindrically shaped piston aggregates the cylinders are placed in circular form. having their axes parallel altogether and equidistant from each other. In the centre of the circle having its axis parallel with those of the cylinders. is the rotative rod (it will be called hereafter the "motor main shaft") which has in its lower extremity a pivot. whose centre with the due eccentricity is located outside the motor main shaft axis. In continuation of the motor main shaft axis. which is also the body's axis. but in a certain distance from the cylinders block. in the lower part of the body is placed the central pivot. having its centre on the motor main shaft axis. At the central pivot. a disc is

pivoted whose centre fits with that of the central pivot. In the central point of the disc, forming one body with it and perpendicularly on it, there is a bar, whose free extremity is pivoted in the eccentric pivot of the motor main shaft. In the periphery of the disc and corresponding to the cylinders axes, connecting rods are pivoted, which in the other extremities have their pistons pivoted.

During the revolving of the motor main shaft, the disc bar axis describes a cone whose basis is the circle described by the eccentric pivot centre, and whose apex is the centre of the disc which is the same as the central pivot centre. The disc itself, which is deprived of the freedom to revolve round the axis of the motor main shaft, takes periodically successive inclined positions, depending on the bar position. Consequently, the pistons, guided inside the cylinders do their alternative straight line motion. Vice versa as it occurs in internal combustion motors, where the pistons get active one after the other, their alternative straight line motion turns in rotative motion of the motor main shaft. In the case the aggregates are internal combustion motors, in order to command the valves, a second disc (called the "distribution disc") is placed upon the heads and co-axially at the motor main-shaft, from which it takes its rotative motion.

In the case of two stroke cycle motors where the working cycle is completed in one rotation of the motor main-shaft, the distribution disc is directly fastened in the motor main-shaft, being endowed in its periphery with a ring segment shaped hump, which commands by turns the clearing valves located in a circle and if necessary, with a second hump, in order to command the pump injectors, which are apart for each cylinder.

In the case of four stroke cycle motors. where the working cycle is completed in two rotations of the motor main-shaft. the distribution disc rotates only one half of the motor main-shaft rotations. and in its periphery has four separated segment ring sized humps. placed with the due displacement in four concentric circles of different diameters corresponding to the valves. One couple of humps commands the inhale and the clearing valves of the uneven numbered cylinders. whereas the two other humps command the valves of the even numbered cylinders.

Other ways to command the valves by humps can be realized through rocker-arms or together rocker-arms and push rods. where the selective contacts are achieved by humps placed in the disc either in concentric circles on the same plane but of various diameters. or in circles on parallel planes and with the same diameter. This brings the placing of the valves to be the same. both for the uneven numbered cylinders and for those of even number.

A shaft traverses the body along its full length with its axis parallel to the motor main-shaft axis. This shaft takes by means of a system of gears. one half of the motor main-shaft rotations and sets in motion the valves command distribution disc. the naphtha pump in the cases of the naphtha motors. or the electric distributor for benzine motors. the lubrication system oil pump. mounted in the oil pan. and by means of a transmission issue. the water pump and the cooling system ventilator.

The commanding disc of the valves. which by means of one. two or four humps. realized an efficacious distribution. can serve in the same time taking occasionally the due mass and shape. as an equilibrium fly wheel. as

well as a friction, as a transmission pulley etc. The above described motor aggregates, both of two stroke cycle or of four stroke cycle, using naphtha or benzine, have cylinders placed in one block, which could be single block or with individual cylinders mounted in a flange. They can be built also with two cylinders blocks which have in common the motor main-shaft with the eccentric pivot, the carter with the central pivot and the disc with the bar. The flanges of the two cylinders blocks are placed parallel and equidistantly from the central pivot centre, with the cylinders axes in one direction or displaced with the one's block towards the others as much as the half of the axial distance. The connecting rods of the second block are pivoted at the same disc, but with contrary directions, in accordance with the cylinders axes, displaced or not.

Another way to place cylinders in a block is to put them in two concentric circles, being the cylinders either in the same radius or in displaced radius. Being different the courses of the pistons of the two circles, and keeping a certain relationship diameter versus course, the cylinder volumes of the external circle differ from those of the internal's which favours the application of this form in two degree compressors, where the air or the compressed gas in the external circle cylinders with smaller volume and higher pressure passes in the second degree pressure at the internal circle cylinders.

The piston aggregates and especially those of the internal combustion motors, built in conformity to this invention, have a series of advantages in comparison to the traditional motors. Placing the cylinders in a circular form, with the motor main-shaft in their centre and with their axes parallel,

the elimination of the crank shaft and its substitution by a disc pivoted only in one point in its centre, gives the aggregate a very simple and compact construction and also the possibility to place in it an almost unlimited number of cylinders, which allows to change the power by varying the number of the cylinders on a very large scale, i.e. to pass from aggregates of few, big, slow pistons to aggregates of numerous, small, fast pistons.

The other great advantage offered by placing the motor main-shaft in the centre of the cylinders block is the simple way of commanding the valves which, being disposed in concentric circles, are very accessible to be commanded by one or four humps placed in a disc, independently of the number of the cylinders, 5, 50, 100, and more.

The variability of the motor power depending on the cylinders number in a large scale gives a more qualified typification of the details, and together with the simplification of the construction in general and of the configuration of several details in particular, such as those of the mechanism to transform the motion, of the distribution system etc., would evidently render the foundry and the whole technology of the engines production in general more easy and less expensive including that of very great and powerful motors (such as for ships and locomotives).

Another important advantage deriving from the cinematic scheme for the transformation of alternative straight line motion into a rotary one, applied in these aggregates according to the invention is its very favourable dynamic. The variable angle that the connecting rods axis forms with the cylinders axis is relatively much smaller compared to that of crank shaft motors. Consequently, the radial component of the forces acting on the piston or the

friction force piston versus cylinder results very small and all the same the friction forces in other couples or knuckle joints are reduced with the possibility of their peculiar changing from slippery friction to a rolling one as a consequence of which we have a reduction of the energy loss in friction. therefore increase of mechanical productivity, fuel saving, shortening of the guiding part length of the piston and also its lightening, the growing of its speed, of its longevity as well as that of the cylinders and of the whole aggregate etc.. The repair of the aggregates too is easier and less expensive.

The invention will now be described by way of some examples and with reference to the relative drawings:

Figure 1 shows the mechanism to transform motion applied according to the invention in an internal combustion motor.

Figure 2-a shows a partial section after the axis of a four stroke cycle internal combustion motor with nine cylinders in monoblock.

Figure 2-b shows the way of placing the cylinders with their numbers, the positions of the valves in the heads and of the humps in the distribution disc, viewed from above.

Figure 3-a shows a section after the axis of a two stroke cycle internal combustion motor, diesel, with fourteen cylinders placed in a block.

Figure 3-b shows the way of placing the cylinders, with their numbers and the position of the humps in the distribution disc, viewed from above.

Figure 4-a shows an internal combustion motor with 2 X 13 cylinders placed in two blocks.

Figure 4-b shows the way of placing the cylinders in two blocks, and their numbers.

First Example

A four stroke cycle internal combustion motor with nine cylinders placed in a block Figure 2-a, and Figure 2-b.

The cylinders block, being in this motor a monoblock, has a cylindrical ring shape, in which the cylinders 10 are placed in circular form, with their axes parallel and in equal distance from each other. On the cylinders block, the support 16 is mounted, having their axes fitted. The support 16 has the motor main-shaft 2 which, staying on two bearings performs rotative motion only. In its lower extremity, the motor main shaft 2 has the eccentric pivot 4. Below the cylinders block and in distance is mounted the carter 20 with the central pivot 7, whose centre is on the motor main shaft 2 axis or of the body axis. In the central pivot 7, which in this case is Cardan Cross type (having two degrees freedom) is pivoted the disc 6 in its centre, and its bar 5, in its free extremity, is pivoted in the eccentric pivot 4 (of the motor main-shaft 2). The connecting rods 8 with the pistons 9 are pivoted in the peripheral area of the disc 6 in a way their pivoting centres to correspond to the cylinders 10 axes and to stretch in the same plan of the disc 6 pivoting centre or of the central pivot's 7. On the cylinders 10 are mounted the heads 11, with the valves placed on them, in a way the inhale valves 12 and the clearing valves 13 of the uneven numbered cylinders and those of the even numbered cylinders to be disposed on four concentric circles with varying diameters. The disc 17, called the distribution disc, mounted co-axially at the motor main-shaft 2, has the half of its rotations. The four humps 18, having a ring segment shape, placed on the disc 17 with the due displacement in four concentric circles with varying diameters in

correspondence to the valves, command directly these valves. A couple of humps 18 commands the inhale valves 12 and the clearing ones 13 of the uneven numbered cylinders, whereas the two other humps command the valves 12 and 13 of the even numbered cylinders, realizing thus the required distribution diagram and the ignition turn 1-3-5-7-9-2-4-6-8- for this motor. The shaft 21 with its two bearing (ball bearings) mounted on the support 16 and on the carter 20 takes one half of the rotations of the motor main-shaft 2 by means of the gears Z-1 and Z-2, whose transmission ratio is 1:2; these rotations, by the help of the gear Z-3 and Z-4, whose transmission ratio is 1:1 transmits their motion to the distribution disc 17. The shaft 21 also, whose axis is parallel with the motor main-shaft 2 axis traverses the disc 6 and sets in function the oil pump 22, mounted on the carter 20, which through the filter 23 inhales the oil in the oil pan 24 and supplies the whole lubrication system. By the same shaft 21 take their motion also the naphtha pump or the electric distributor that might be placed upon the support flange 16, and through a transmission issue also the water pump together with the ventilator.

Second Example

A two stroke cycle internal combustion motor, diesel, with 14 cylinders placed in one block. Figure 3-a and Figure 3-b

In these motors the cylinders block is made up by single cylinders 10 mounted on the flange 1. The flange 1, the support 16 that holds the motor main-shaft 2, and the carter 20, having the central pivot 7 in the centre, are made a body, the motor body, by means of four distanciator bolts 25, which

traverse the disc 6 in its four spaces. The distribution disc 17 is fixed directly on the motor main-shaft 2 and hence takes its rotations. The two humps 18 in the disc 17 periphery command directly, the one of them the gas clearing valves 13, the other the pump injectors 19 that are apart for each cylinder. Being a two stroke cycle motor, its ignition turn is 1-2-3-4-5-6-7-8-9-10-11-12-13-14- . The shaft 21 its axis being parallel with those of the distanciator bolts 25 and with that of the motor main-shaft 2 from which it takes its rotations by means of the gears Z1 and Z2, traverses the disc 6 and sets in motion the oil pump 22, also through the gear 26, the shaft 27, which rotates above the supports 28 and is coupled to the washing turbine 29 which by means of the intake manifold 30 put air in the cylinders. The central pivot 7 in this motor, as a variant, is chosen of a spherical type with three degrees of freedom. In order to take it off a degree of freedom, that to rotate round the motor main-shaft 2 axis, a pin 14 is put in a radial direction on the disc 6 and the archly shaped guide 15 on the body.

Finally, it is worth to say that the motor bodies, built according to this invention result in simpler frames.

Third Example

Internal combustion motors with 2 X 13 cylinders placed in two blocks.

Figure 4-a and Figure 4-b

The motors of this example are with two blocks cylinders, that can belong to different types and are built in the same way to those of the second example. In these constructions we have two flanges 1 of the cylinders 10, two supports 16 with their motors main-shaft 2 and one carter 20 with the

central pivot 7, elements that get united as a body, according to defined distances and conditions, by means of the distanciator bolts 25 which traverse the disc 6. The flanges 1 of the two cylinders blocks are placed parallel, in front to each other and equidistant from the central pivot 7 centre with the cylinders axes parallel and displaced as much as the half of the distance between axes. The connecting-rods 8 of the second block are pivoted in the disc 6 in the contrary direction to those of the first block and displaced in order to correspond to the relative cylinders axes. The shaft 21 having its axis parallel to the body axis, traverses the disc 6 and the carter 20, and by means of the gears couple Z transmits motion and power from the active motor main-shaft 2 to the deprived of the eccentric pivot 4 second block passive motor main-shaft 2 and to all auxiliary equipments necessary for the motor type.

Having insight the rotation sense of the two distribution discs 17 for setting in phase, and designating the first block cylinders with numbers from 1 to 13, whereas the second block ones from 1' to 13', placed diametrically contrary (180 degrees) we will have a simultaneous ignition for the identically numbered cylinders of the two blocks, in the following succession, for the two-stroke cycle motors: 1+1', 2+2', 3+3', 4+4', 5+5', 6+6', 7+7', 8+8', 9+9', 10+10', 11+11', 12+12', 13+13'

and for the four stroke cycle motors: 1+1', 3+3', 5+5', 7+7', 9+9', 11+11', 13+13', 2+2', 4+4', 6+6', 8+8', 10+10', 12+12'

motors of such kind of construction, which render possible a redoubling of cylinders in the same aggregate diameter, can be used with priority in course cars (race cars-Formula 1) as well as in aviation, navy etc.

CLAIMS

1. The cylindrically shaped piston aggregates are composed by the cylinder block that can be one or two in an aggregate. which has the cylinders (10) mounted on the flange (1) in a circular form. having their axes parallel. In the centre. and parallel to the cylinders (10) axes. is placed the motor main-shaft (2). mounted on the support (16). In continuation of the motor main-shaft (2) axis. in a distance from the cylinders block. is placed the carter (20) with the central pivot (7). on which is pivoted the disc (6) with the bar (5). whose free extremity is pivoted in the eccentric pivot (4). In the peripheral area of the disc (6) are pivoted the connecting-rods (8) with the pistons (9). Above the cylinders (10) are placed the heads (11) with the valves (12) and (13). Upon the heads (11). in order to command the valves. is placed co-axially at the motor main-shaft (2) the distribution disc (17). The distanciator bolts (25). traversing the disc (6) fasten making up a body of the supports (16) of the motor main-shaft (2). of the cylinders (10) flange (1) and of the central pivot (7) carter (20). Lastly. as well as the shaft (21) which serves to transmit the motion and the power to the auxiliary equipments.

These aggregates are characterized by the circular form of placing the cylinders (10) with axes parallel among them and to that of the motor main-shaft (2) placed in the centre of their circle: by the formation of the body. composed by the supports (16). the flanges (1) and the carter (20). united together by means of the distanciator bolts (25) after a central axis - the body axis - which coincides with the motor main-shaft (2) axis and passes in

the central pivot (7) centre: by the pivoting of the disc (6) to the central pivot (7) as well as of the bar (5) at the eccentric pivot (4). rendering so possible the disc (6) inclination in all directions depending on the bar (5) position. and impeding its revolving round the motor main-shaft (2) axis: by the pivoting of the bar (5) in the eccentric pivot (4) fitting their axes in one unique; by the pivoting of the connecting -rods (8) with their pistons (9) in the disc (6) periphery having their pivoting centres in correspondence to the cylinders (10) axes and in one plane with the pivoting centre of the disc (6): by commanding of the heads (11) valves (12) and (13) through the humps (18) of the distribution disc (17) co-axially placed at the motor main-shaft (2) directly or with the mediation of the rocker-arms and the push rods: by placing the shaft (21) parallel to the motor main-shaft (2) from which it takes its rotations.

2. The Cylindrically shaped piston aggregates. according to claim 1 are characterized by the circular disposition of the cylinders (10). having their axes parallel and equidistant among them. and by placing in their centre of the motor main shaft (2) with its axis parallel to those of the cylinders (10).

3. The cylindrically shaped piston aggregates. according to claim 1 are characterized by the formation of the aggregate body. composed by the supports (16). the flanges (1) and the carter (20). united together by means of the distanciator bolts (25) after a unique central axis - the body axis- which coincides with the motor main shaft (2) axis and passes in the central pivot (7) centre.

4. The cylindrically shaped piston aggregates. according to claim 1 are characterized by the pivoting of the disc (6) at the central pivot (7) and of the bar (5) at the eccentric pivot (4). rendering possible the disc (6) inclination in all directions depending on the bar (5) position and impeding its revolving round the motor main-shaft (2).

5. The cylindrically shaped piston aggregates. according to claim 1 and 4 are characterized by the pivoting of the bar (5) to the eccentric pivot (4). fitting their axes in one. in order for this axis to form with the motor main-shaft (2) axis an angle having its apex in the central pivot (7) centre.

6. Cylindrically shaped piston aggregates. according to claim 1 are characterized by the transmitting of motion and power among the pistons (9) and the disc (6) by means of rigid connecting rods (8). pivoted in the two extremities. in the one at the piston (9) axis. in the other in the disc (6) periphery. in order the pivoting centres to be equidistant among them. equidistant from the disc (6) centre. in correspondence with the cylinders (10) axes and in one plan with the pivoting centre of the disc (6).

7. Cylindrically shaped piston aggregates. according to claim 1 are characterized by the commanding of the valves (12) and (13) by means of the humps (18) belonging to the distribution disc (17) which is placed co-axially in the motor main-shaft (2) with a direct command or by the mediation of the rocker-arms and the push rods.

8. Cylindrically shaped piston aggregates. according to claim 1 are characterized by the shaft (21) placing. with its axis parallel to that of the motor main-shaft (2). from which it takes its rotations. This shaft (21) traverses the disc (6) and the whole body to transmit the rotations and the power among the various equipments and elements.

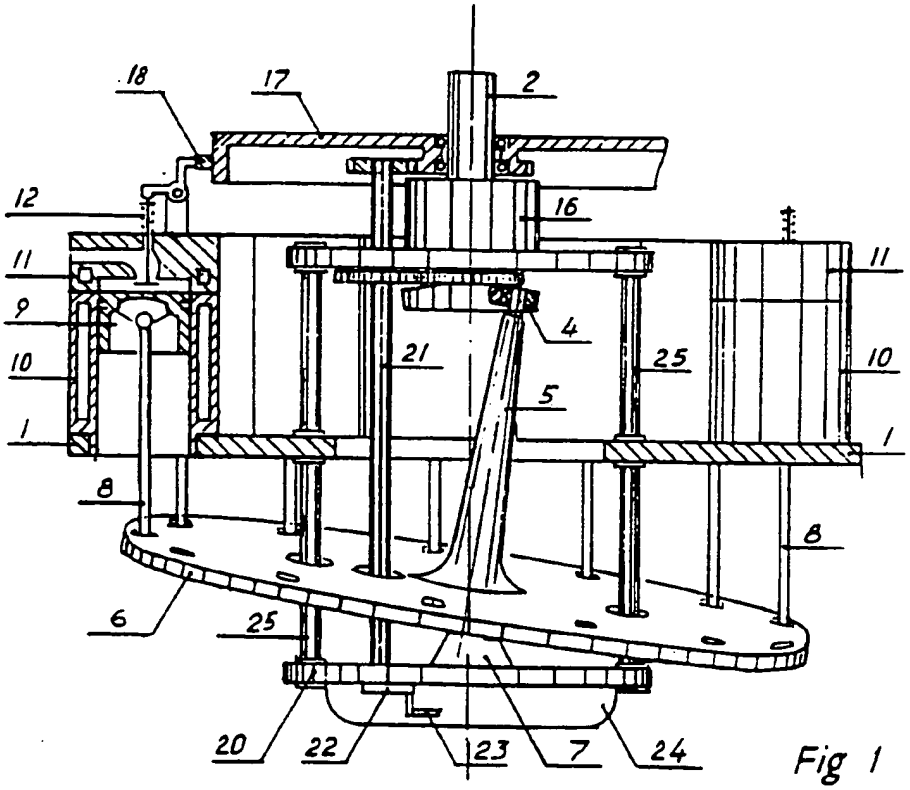


Fig 1

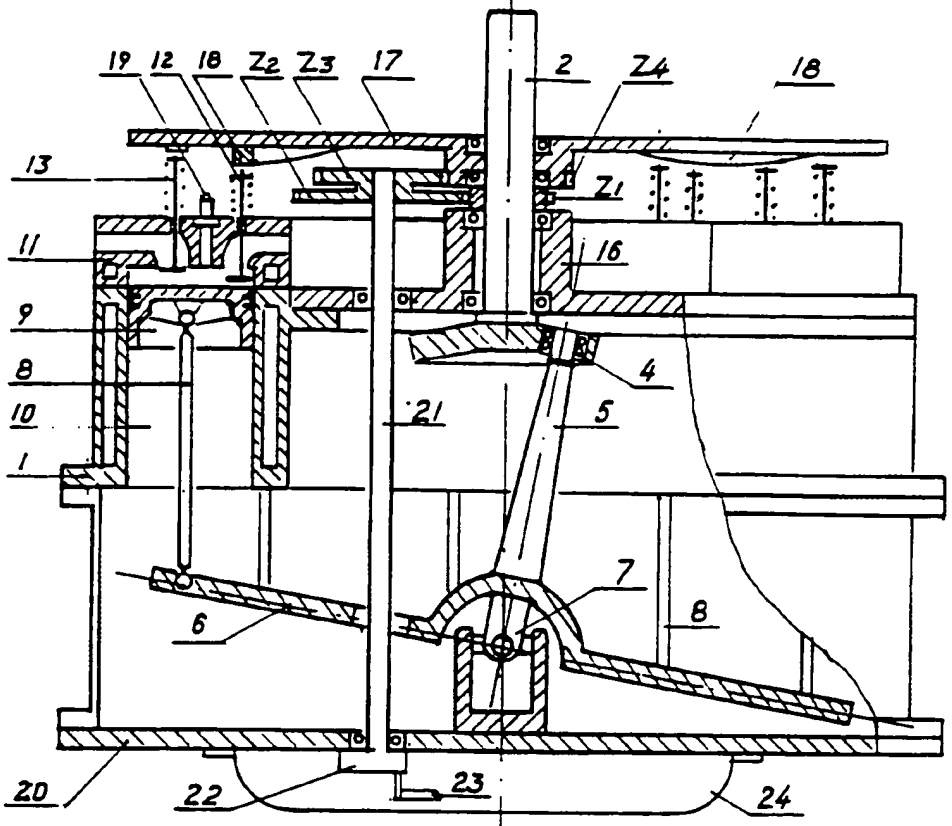

19
12
18
Z2
Z3
17
2
Z4
18
13
Z1
11
16
9
8
4
10
21
5
1
7
6
8
20
22
23
24

Fig 2 - a

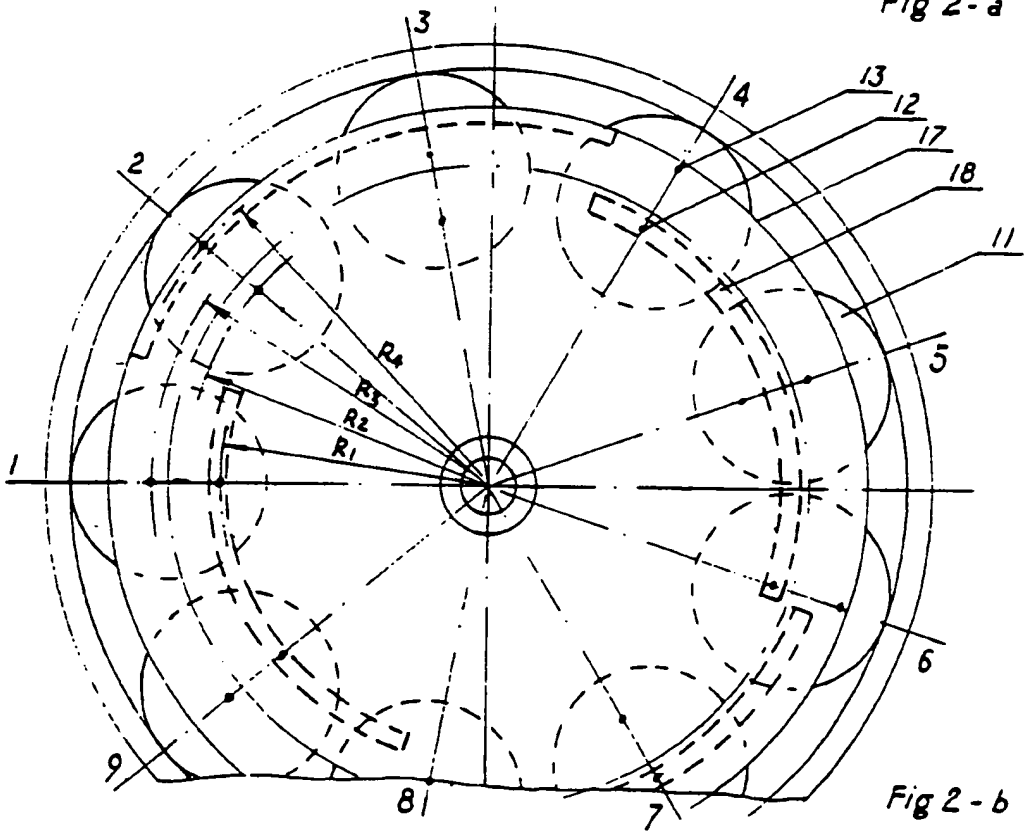

3
4
13
12
17
18
11
2
5
R4
R3
R2
R1
1
6
9
8
7

Fig 2 - b

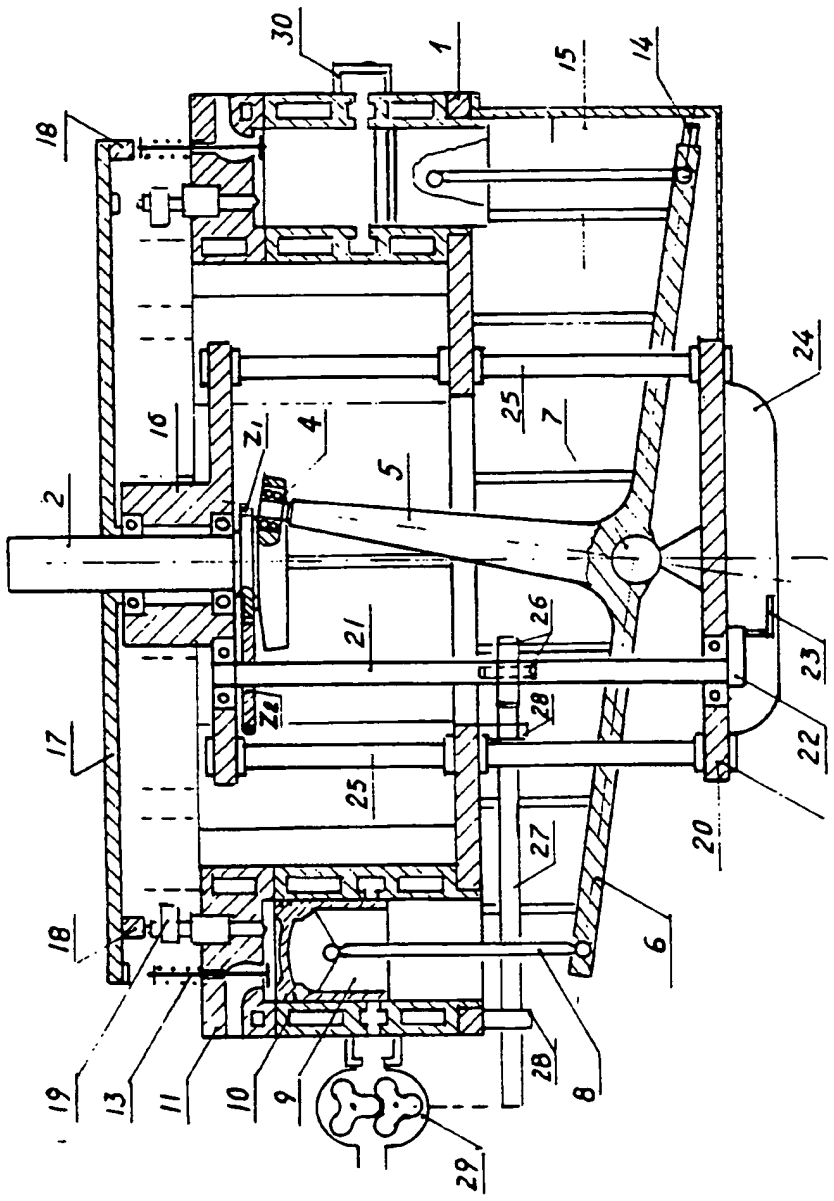

30
1
15
14
18
24
16
21
4
25
7
5
2
26
21
23
28
17
22
25
27
20
18
6
19
13
11
10
9
28
8
29

Fig 3-a

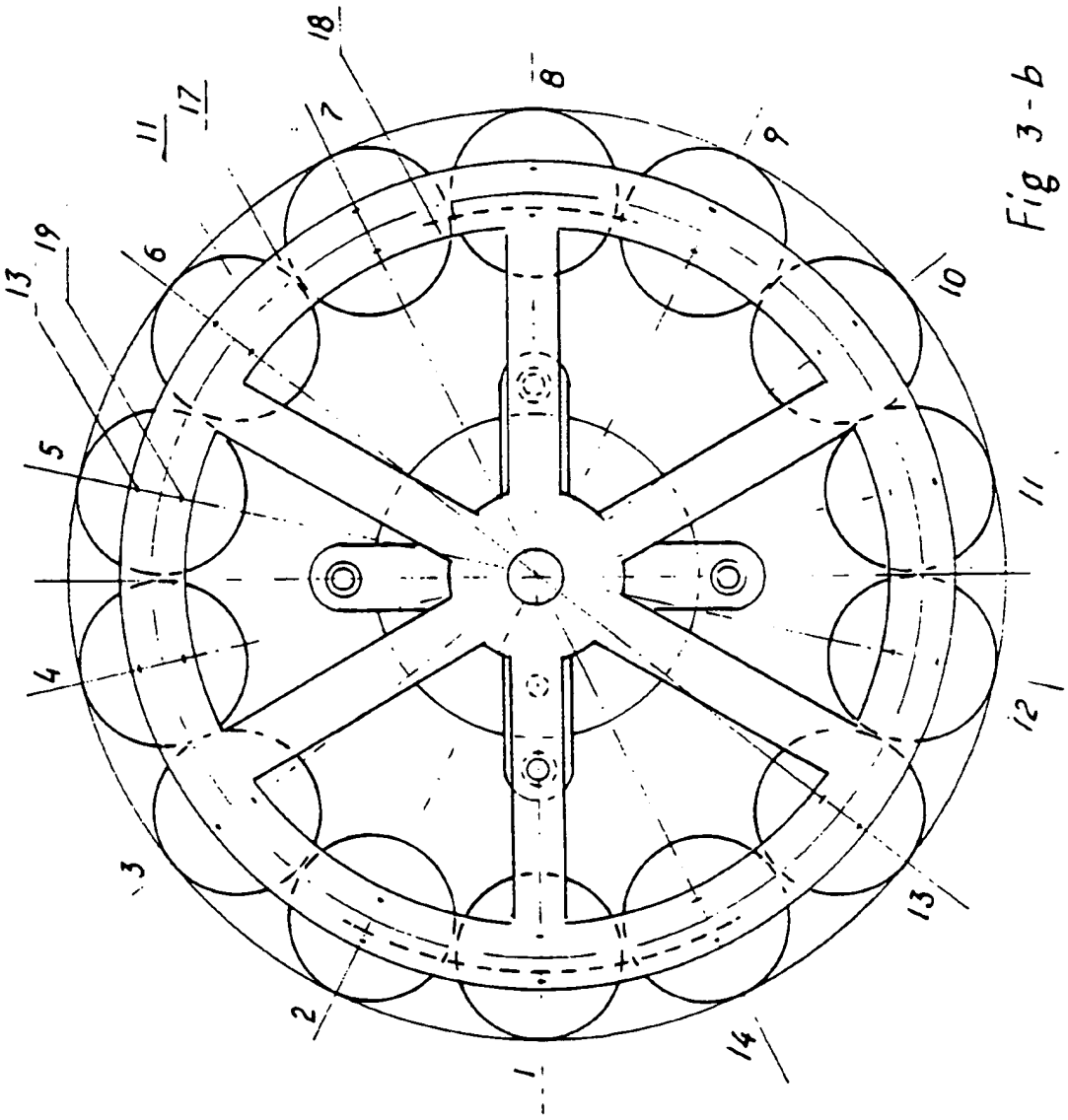


Fig 3 - b

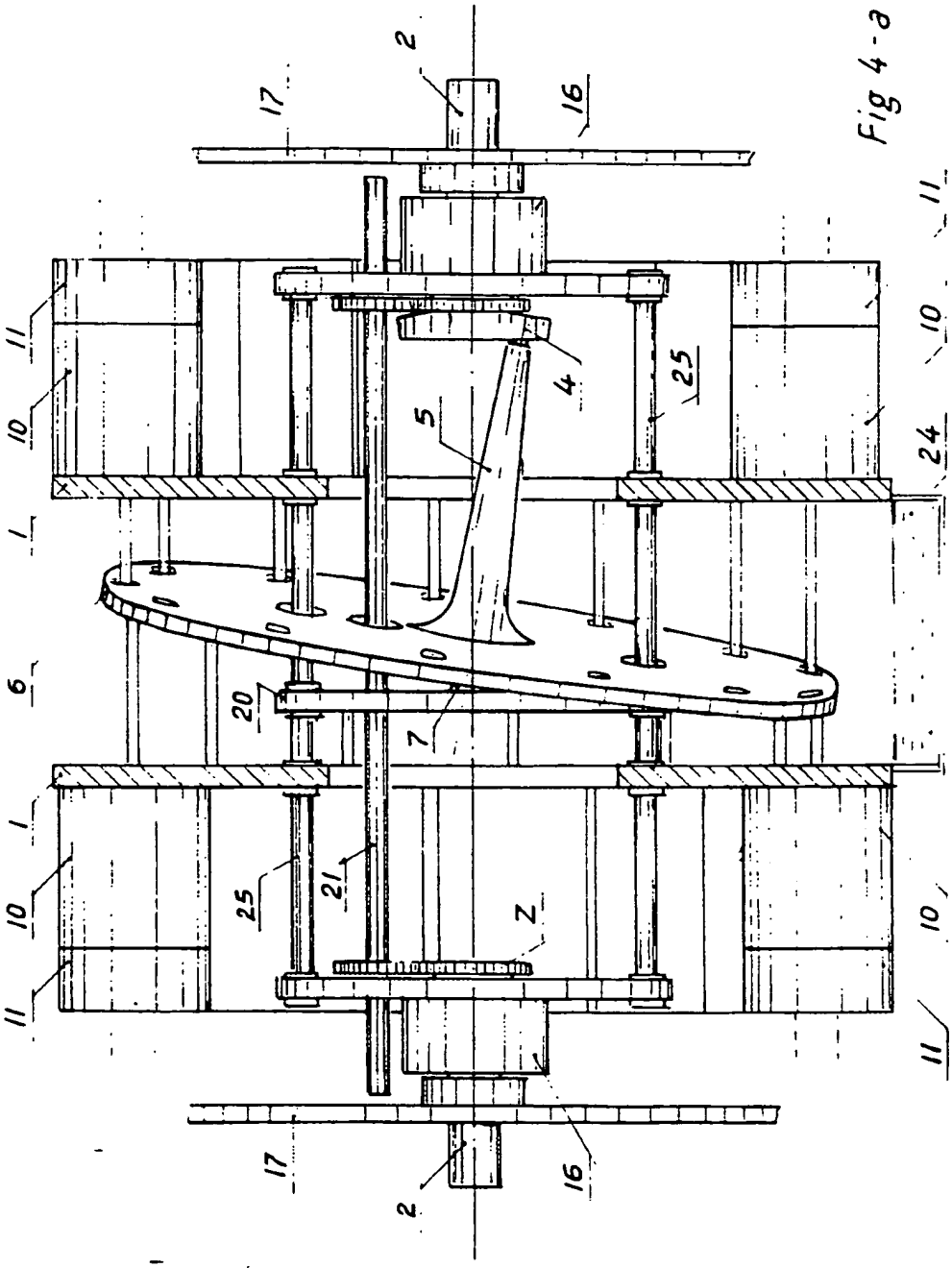


Fig 4 - a

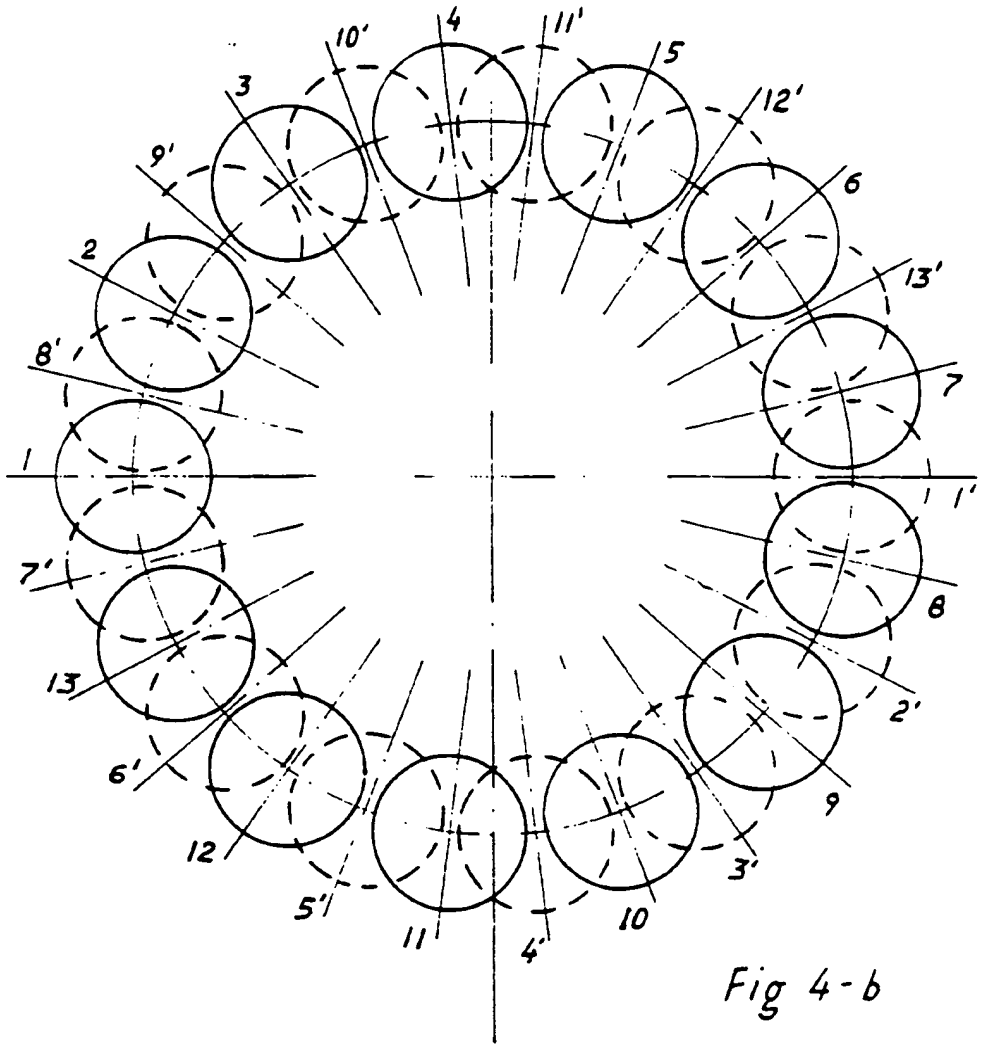


Fig 4-b

INTERNATIONAL SEARCH REPORT

Intl. ..ional Application No
PCT/AL 96/00001

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 F01B3/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 F01B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR,A,1 416 219 (MARO) 4 February 1966 see the whole document	1-8
X	EP,A,0 339 810 (ARMSTRONG RICHARD J) 2 November 1989 see page 4, line 47 - page 5, line 33; figures 1,2,4	1-8
A	US,A,4 565 118 (GIRODIN GEORGES H) 21 January 1986 see the whole document	1
A	US,A,3 198 022 (DE WAERN) 3 August 1965 see figure 3	1
A	US,A,5 113 809 (ELLENBURG GEORGE W) 19 May 1992 see the whole document	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 November 1996	06.12.96

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	Mouton, J

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/AL 96/00001

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
FR-A-1416219	04-02-66	NONE		
EP-A-0339810	02-11-89	US-A-	4928576	29-05-90
		AU-B-	609269	26-04-91
		AU-A-	3140389	02-11-89
		CA-A-	1327554	08-03-94
		DE-T-	68907637	24-02-94
		JP-A-	1305130	08-12-89
US-A-4565118	21-01-86	NONE		
US-A-3198022	03-08-65	NONE		
US-A-5113809	19-05-92	NONE		